AUTOMATIC SYSTEMS
LABORATORIES

F100 Precision Handheld Thermometer

User Manual

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Conventions used in this manual

Structure of manual

The manual is divided into sections. Each section deals with a specific topic or related topics. Sections are displayed in a regular, bold typeface, for example - **1.0 Introduction**. Sections are sub-divided into sub-headings, for example - ***1.1 Features***. These may also be subdivided in turn.

Terminology

The terms Precision thermometer, thermometer, F100 and instrument are used interchangeably in this manual.

Warnings and Notices

These appear in the body of the text, clearly displayed with a box surrounding the text. The first word within the box displays the type - **Warning** or **Note**.

A **Warning** (double box) is designed to draw attention to an aspect that may cause danger to the user or damage to the instrument. A **Note** (single box) is used to bring special attention to something important requiring action or avoidance.

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Important safety information

Read and understand the user instruction manual before attempting to use the instrument.

The F100 is a handheld, battery operated, thermometer. It must not be used for any other purpose.

Warning

The protection provided by the instrument may be impaired if the equipment is not used in the manner specified.

Only replace items or components with an approved or equivalent spare part. All spare and consumable parts are available from ASL.

Warning

The instrument is NOT designed to be used in an explosive atmosphere.

Warning

The instrument is NOT designed to be used in medical environment

- × Do NOT use the instrument near water or in damp conditions
- × Do NOT clean the instrument with solvents
- × Do NOT insert objects into openings
- × Do NOT place the instrument, battery-pack or charger onto a hot or cold surface
- × Do NOT place any weight on top of the instrument, battery-pack or charger

- ✓ Do ensure air can freely circulate around the battery compartment and power-supply during charging
- ✓ Do use the correct USB lead supplied

Warning

Do NOT open the case. There are no user serviceable parts inside.

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Warning

Inspect cables and probes regularly, ensuring that their insulation is not damaged

Warning

The instrument and batteries must be disposed of in accordance with local regulations.

Please refer to ASL if the instrument is to be disposed of within the European Union.

General warning symbol. This indicates that a hazardous condition or general danger may exist. **You must read the relevant sections in the User Manual Handbook before operating the instrument.**

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Important battery charger safety information

The battery charger and battery pack are supplied for use with the F100.

Warning

Only use the battery charger supplied. Use of any other charger will invalidate the warranty and may lead to the danger of overheating and to permanent instrument damage.

The battery charger supplied must NOT be used with other equipment.

Warning

Do NOT cover the battery charger, battery pack or instrument during charging.

Ensure air is free to circulate around these items during charging.

Warning

Do NOT short the contacts on the battery compartment with any metallic object.

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Important Probe safety information

Care must be taken with probes used with the instrument. The following safety information must be observed.

× Do NOT lift the F100 by any of the leads

✓ Do ensure that long probe-leads are kept away from areas where people could trip over them or become tangled in them

✓ Do ensure the probe-leads are kept in good condition

Warning

Because of the nature of the instrument, probes can be excessively HOT or COLD during use. Take suitable precautionary measures when handling probes.

Take care that you (and other people working in the same area) do not come into contact with the metallic probe or the insulating sheath near the probe, which will also be hot/cold.

Precautions apply both during use or when moving the probe from one position to another.

Warning

Probes may be immersed in various chemicals during use. Some of these chemicals may be dangerous or harmful (even when the probe is cold).

Always assume that the probe has been used this way and DO NOT touch the probe without suitable protective clothing.

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1.0 Introduction

1.1 Overview

The F100 Precision Handheld Thermometer is a highly accurate instrument designed for laboratory, commercial and industrial temperature measurement and calibration applications.

Features include:

- Two input channels
- A large graphic LCD display for excellent viewing of temperature measurement values and instrument settings
- USB communication interface as standard for automated monitoring and calibration applications
- Calibration against traceable external standards

The F100 will operate with all 4-wire Pt100 (100 ohm) Platinum Resistance Thermometers (PRTs) and with virtually all NTC thermistors.

Temperature measurement units are user-selectable and can display °C, °F, K and Ω. Overall system accuracy will depend on the sensor quality and calibration - see the specification section.

1.2 Definitions and Terminology

i. 0℃ = 273.15 K

ii. 1 mK (milli-Kelvin) = 0.001°C (one milli-degree Celsius)

iii. 1 milli-degree C = 0.001 °C = 1m°C = 1mK = 1.8m°F

iv. 1 milli-degree F = 0.001°F = 1m°F = 0.56mK = 0.56m°C

v. Alpha, or α, is the temperature coefficient, or temperature sensitivity, of the platinum wire used in PRTs. In general, the greater the alpha value, the better the PRT thermometer measurement reproducibility, stability and performance

vi. Abbreviations for platinum resistance thermometers include -

PRT (Platinum Resistance Thermometer)

Pt100 (PRT with nominally 100Ω resistance at 0°C)

RTD (Resistance Temperature Device)

vii. NTC is an abbreviation for Negative Temperature Coefficient thermistors

viii. System accuracy refers to the overall, combined accuracy of the F100 and thermometer.

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1.3 Principles of measurement

The F100 measures the voltage (V_t) developed across the unknown sensor resistance (R_t) and the voltage (V_s) across a stable internal reference resistance (R_s). The voltages are proportional to the resistances so the thermometer resistance is derived from –

$$R_t = R_s \times \frac{V_t}{V_s}$$

This technique achieves immunity from slow moving time and temperature drifts in the electronics, as it is not affected by voltage measurement gain variations or current source fluctuations.
In the same way that AC resistance measurement eliminates thermal EMFs, switched DC achieves a similar advantage. Switched DC works by reversing the current flow on alternate measurement cycles and taking the average value, thereby minimising any thermal EMF offsets from the measurement.

For PRTs, the relationship between resistance and temperature varies slightly from one PRT to another. Therefore, no matter how accurately the F100 measures the PRT resistance, if the relationship between resistance and temperature for a particular PRT is not known, accurate temperature measurement is not possible. For thermistors, the relationship depends totally on the thermistor type and specifications.

The F100 uses PRT and thermistor calibration data to overcome this problem and calculates the result from temperature conversion functions stored in either the sensors 'SMART' connector or the F100's internal non-volatile memory. This method enables the F100 to convert resistance to temperature, uniquely for each sensor used.

It is very important, therefore, that a sensor without a 'SMART' connector is used on a properly configured input channel and that the probes' coefficients are correctly entered into the instrument.

Note

For non-Smart probes, always check that the coefficients are correct set for the probe being used.

Failure to do so, may lead to incorrect measurements.

System accuracy is a combination of the F100 accuracy in measuring sensor resistance and the calibration uncertainty placed on PRTs and thermistors by the calibrating laboratory.

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2. Setting up the F100

2.1 Safety information

- Please read the safety information section before attempting to operate the F100 located on page 1.6 onwards.

2.2 Unpacking the instrument

When you unpack the F100 thermometer, check that the following items are present before using the instrument[1] -

- F100 precision thermometer
- Battery charger
- Operator's handbook on CD
- Calibration certificate
- USB lead
- Thermometer probes (if ordered) will be packed separately

Please contact the ASL Technical Services Group immediately if any of these items are missing or damaged.

Please retain the packaging. In case of return, servicing or calibration, use the original packaging. Failure to do so may invalidate the warranty and/or incur additional costs outside the warranty period. Please contact your agent when the original packaging is unavailable.

[1] Thermometer probes (if ordered), will be supplied separately

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3. About the F100

This section will introduce you to the features and functions of the F100 Precision Thermometer. Each of the features is explained in turn. Once the F100 has been set-up to your particular requirements, all the commonly used functions are available using single key-strokes.

3.1 The Front Panel

Figure 3.1- Front panel

3.2 About the display screen

The large graphic LCD screen is your direct link to the instrument, presenting you with the measurement results and information or menus to set and control the instrument.

The LCD screen is designed for reflective-viewing under normal ambient lighting; a backlight is provided for use when ambient conditions are darker.

3.3 The Keypad

The F100 keypad is shown below. The keys are used to select the various menu options. Generally, no more than two menu levels are used. A few (infrequently used options) require three menu levels. Operation is simple once you are familiar with instrument.

It may help to have the instrument to hand when reading through these sections.

Refer to section 4 for a detailed description of how to use the keys to operate the instrument

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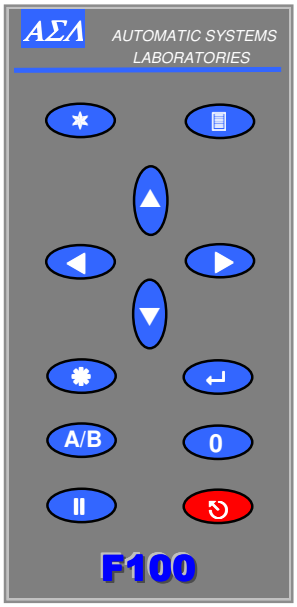

Key	Function
▤	Menu display
✱	Backlight
▲	Up arrow
▼	Down arrow
◀	Left arrow
▶	Right arrow
❋	Clear (view statistics)
↵	Enter
A/B	Channel and differential select
0	Zero (offset) reading
⏸	Hold reading
⏻	Power on/off

Figure 3.3 – F100 Keypad

3.3.1 Keypad overview

The red **Power** (⏻) key turns power on and off[2] to the F100.

The F100 uses a menu system. The **Menu** (▤) key is located at the top right of keypad. Use the **Menu** key to access to the less frequently used F100 functions. The four **Arrow** (▲ ▼ ◀ ▶) keys are used to navigate through the menus; the **Enter** (↵) and **Clear** (❋) keys are used to act on the menu selections[3].

The **Backlight** (✱) key located at the top left of the keypad provides LCD illumination when the ambient light-level is too low for normal viewing.

The **A/B** key is used to select one of the two channels (A or B) or the difference (A – B)

The **Zero** (**0**) key is used to provide relative (offset) readings.

The **Hold** (⏸) key is used to freeze the current reading.

[2] The F100 may also be set to power-off after a preset period.

[3] The **Clear** (❋) key is also used to view F100 statistics; press once to select the statistics page. Press any key to return.

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3.4 F100 thermometer inputs

There are two input channels; two 5 pin DIN input-sockets are located at the rear of the instrument. These are designed to take either PRT or thermistor probes. Channel A is colour-coded red. Channel B is colour-coded blue.

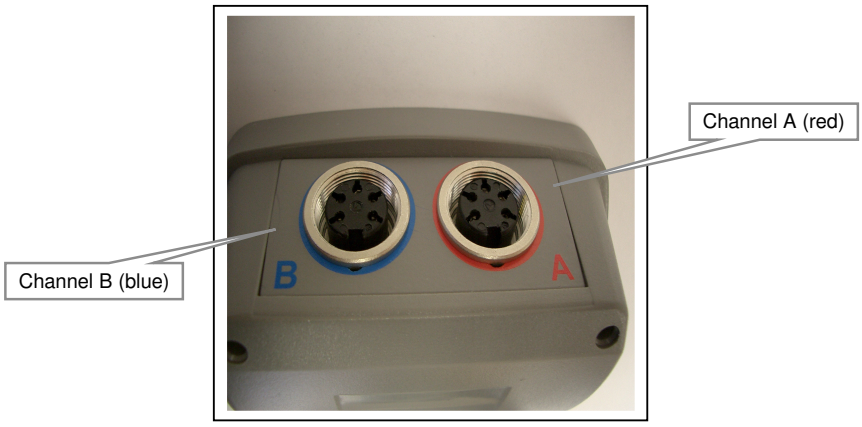

Figure 3.4 - Rear panel

Either channel can accept either Smart or Passive probes; any combination of probes can be use together. Smart probes (described in section 6.0) contain their own calibration information and communicate this to the F100 as soon as they are used. Passive probes do not contain calibration information and the F100 must be set-up with the calibration information for each probe used (and each time the probe is changed).

Probe connection information for both PRTs and thermistors[4] is shown below (viewed looking towards the sockets) -

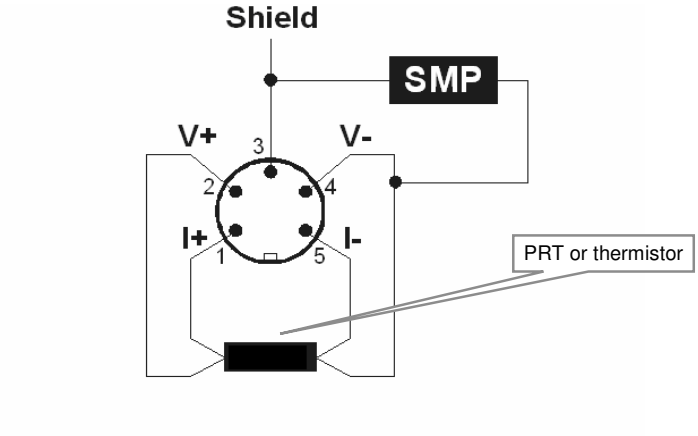

Figure 3.4.1 4-Wire SMART probe PRT/thermistor input

[4] Two wire PRTs/thermistors must have the probe pins1 & 2 connected together and also pins 4 & 5 connected together.

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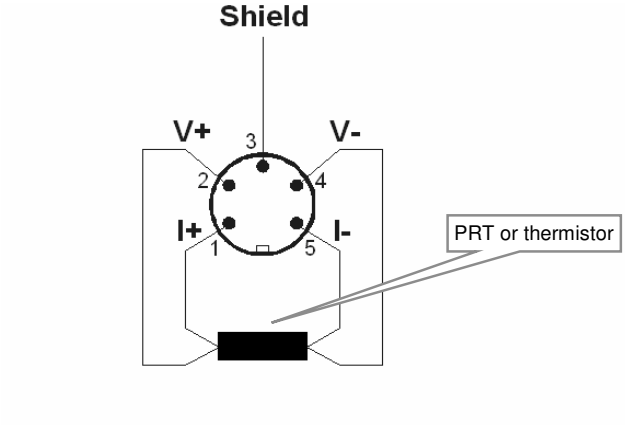

Figure 3.4.2 4-Wire Passive probe PRT/thermistor input

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3.5 Battery Pack

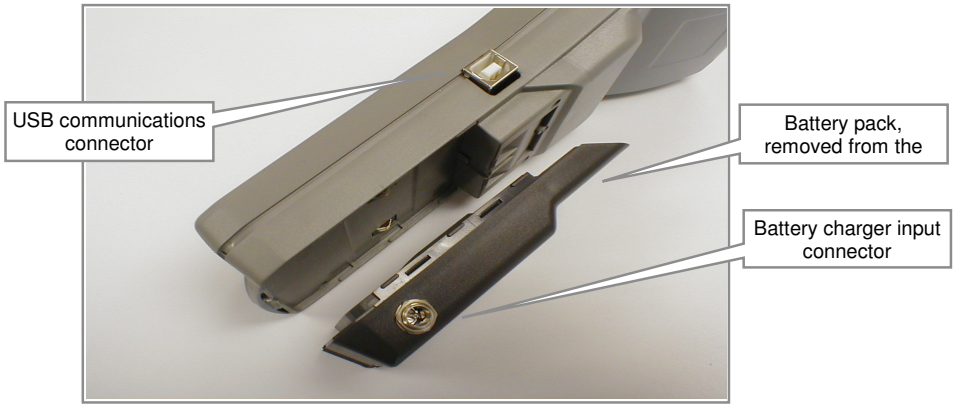

Figure 3.5 - Base of the F100 showing the battery back removed

The instrument operates from battery power (or from a powered USB cable when connected to a PC). The battery pack is replaceable.

3.5.1 Removing and replacing the battery pack

To remove the battery pack, press the latching tab and slide the battery pack back. See figure 3.6 for details.

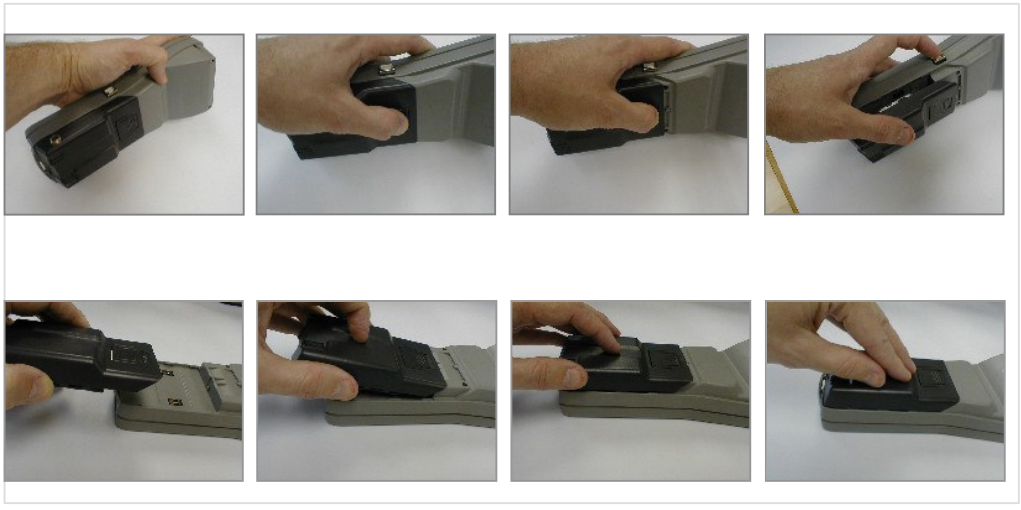

Figure 3.6 – Removing and replacing the battery pack

To replace the battery pack, place the pack in position before sliding home. See figure 3.6 for details. Do check that the battery pack is securely in position before using the instrument.

3.5.2 Battery charger

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The batteries are located in a removable pack located on the base of the instrument. The batteries may be charged in-situ or the battery pack may be removed and recharged separately (spare battery packs are available). Refer to page 1.8 for additional safety information.

Note

Batteries are shipped fully discharged. The battery pack should be fully charged before first-use. It is shipped fully discharged.

The battery pack contains two NiMHi cells in series and a charger control circuit. The battery pack must only be charged using the unit supplied.

Warning

Only use the battery charger supplied. Use of any other charger will invalidate the warranty and may lead to the danger of overheating and to permanent instrument damage.

The battery pack has a socket on its side that accepts the chargers' connector. The F100 may be used when the battery pack is being charged, but its performance may be degraded.

Note

It is recommended that the battery pack is removed from the F100 for charging.

Check that the small LED visible through the bottom of the battery pack flashes during charging. Flashing ceases when the battery is fully charged.

Warning

Take care not to short the battery packs' contacts with any metal object when the pack is not connected to the instrument.

Warning

Take care not trap any part of your hand when closing the battery compartment.

The AC battery charger provides various interchangeable mains connectors; select the one that you require - see the charger pack for details.

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Note

Disconnect the charger when not in use.

3.5.3 Name plate(s)

The instrument rating plate shows the instruments maximum power consumption and instrument serial number. The label on the battery charger shows its AC voltage range and operating supply frequency and current.

3.5.4 USB Communication interface connector

The USB connector is fitted as standard (see figure 3.5). Communication requires the installation of the USB driver on a PC; see the separate information supplied on the CD. A standard USB cable is supplied with the F100.

The instrument can be used with ASL's ULOG program (supplied on the CD) or simply used to transmit ASCII data, which may be recorded using a simple terminal program.

The F100 is designed to work with power supplied by a USB connector that is suitably supported by a PC.

Note

The power supplied by a USB cable connected to a PC may be noisy.

ASL can accept no responsibility for any performance degradation for a F100 connected or powered this way.

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4. Operating the F100

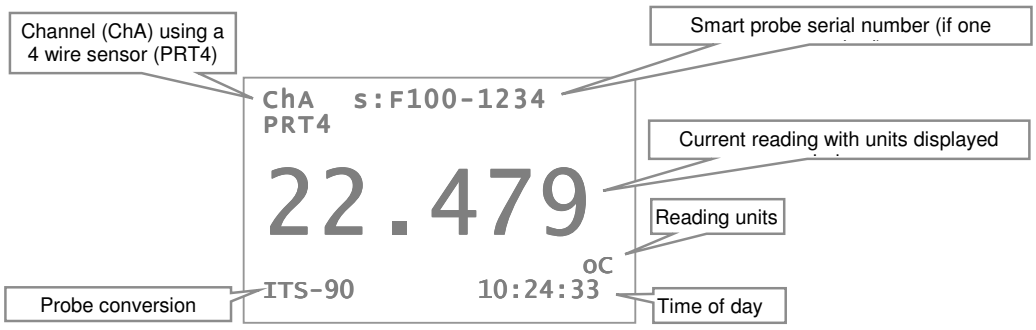
4.1 Instrument operating modes

The instrument has two operating modes -

- **Measurement Mode** that displays the measurement readings and status information
- **Menu Mode** that lets you select and alter the instrument operation and its settings

4.1.1 Measurement Mode

In Measurement Mode, the LCD displays the current reading (temperature or resistance), the unit symbol, the channel and type of sensor selected (and conversion method); the time of day is also shown[5]. This is the normal operating display for the F100. The display will look similar to the one shown below –



This display always reflect the operation of the instrument, showing the current reading(s) and settings.

Readings are updated at the normal conversion rate of one every two seconds.

[5] The time text will be replaced by 'Logging' or 'Remote' when these modes are selected

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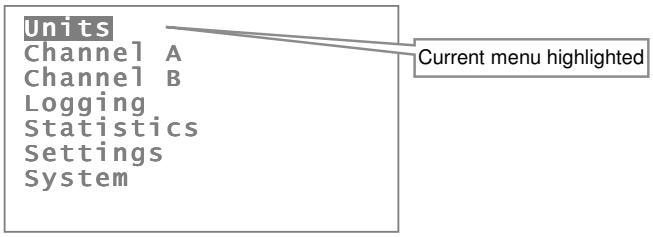
4.1.2 Menu Mode (▤ key)

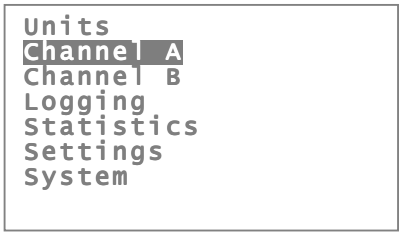
In menu mode, the LCD displays the various options available to control F100 operation.

Press the **Menu** key (▤) to select the menu screen.



The (highlighted) reverse-video background shows the menu item that will be selected when the **Enter** key (↵) is pressed (Units selection in the example above). Further menu options may follow once the **Enter** key is pressed.

Press the **Up** (▲) and **Down** (▼) keys to move through the options. Pressing an up/down key will move the reverse video selection one line up or down one line[6]. Once the selection is correct, press the **Enter** key. So, for example, to change channel A options, press the **Down** key (▼) once to obtain the display shown. Now press the **Enter** key once (↵) to select this option.



The following screen will appear (when a Smart probe is connected to channel A). The display will be different if a passive probe is attached instead.

Press the **Down** key (▼) once to obtain this display. The **SMP Probe Info** line will be highlighted.

Now that this menu has been highlighted, press the **Enter** key (↵) once to obtain the display shown. The selection moves down one line and the **SMP Coefficients** line will be highlighted.

[6] The selection line will wrap round from top to bottom (or bottom to top) on repeated arrow presses.

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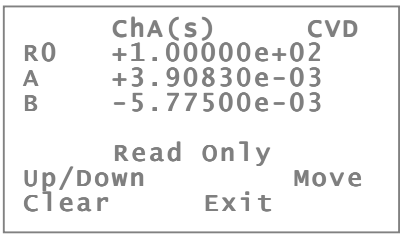


In this example, pressing the **Up** or **Down** key will display more of the Smart probes' coefficients.

Press the **Clear** key (✱) to return the display to the previous menu. Press the **Clear** key (✱) once more to return to Measurement Mode. Alternatively, press the **Enter** key (↵) to return the F100 immediately to Measurement Mode (these actions generally applies to all lower level menu options).

No changes can be made in this example. When changes are made, all settings are stored and retained when power is removed.

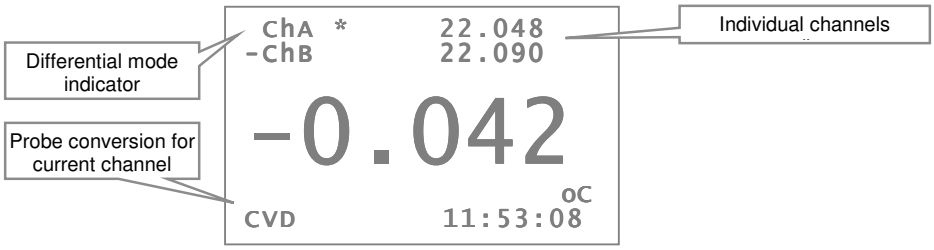
4.1.2.1 Selecting the thermometer input channel and differential mode (A/B key)

The channel **Select** key (**A/B**) is used to change between channels and also to select the differential operational mode, (**A – B**). The channel selection order is –

Channel A ➔ Channel B ➔ Channel (A – B) ➔ Channel A

A missing (or faulty) probe will be indicated on the display by a series of dashed lines.

In differential mode (when both channel A and channel B have probes connected), the screen will look similar to the following example. The asterisk next to the ChA and ChB legends will alternate as readings are updated.



The probe conversion indicator (bottom-left) displays the conversion method for the current reading (and so will alternate if the two channels have different conversion methods).

4.1.2.2 Selecting relative temperature measurement (0 key)

The instrument displays a reading value relative to a fixed offset in **Zero** (or relative) mode. Press the **Zero** (**0**) key to select this mode.

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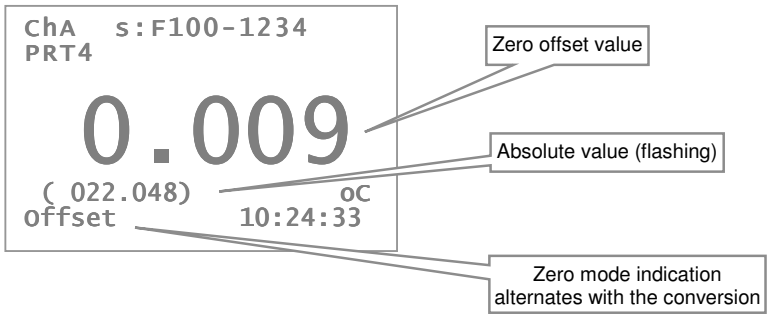
In **Zero** mode, the instrument stores the last reading (at the time of **Zero** key press) and subtracts it from all subsequent readings. It continues to do this until it is either cancelled (by pressing the **Zero** key again) or until power is removed.

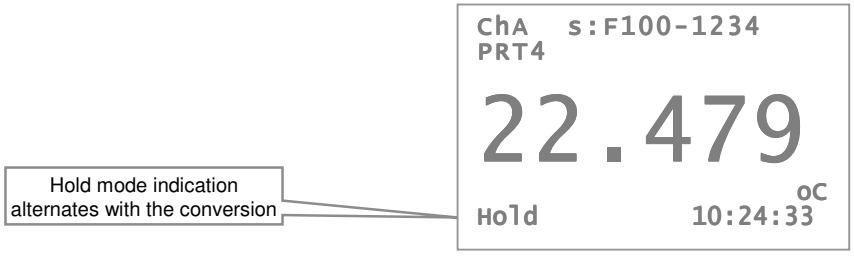


Zero mode also works on differential measurements (A – B). In this case, both channels values are frozen at the time the key is pressed. The absolute value, in the example above, is replaced by the relative difference value.

To cancel the relative measurement mode, press the **Zero** (**0**) key again. Zero mode is cancelled when power is turned off.

4.1.2.3 Selecting run/hold mode (⏸)

Instrument measurements stop completely when **Hold** mode is active. This is indicated on the bottom-left of the display where **Hold** mode indication alternates with the current conversion method, providing a flashing indication. Hold mode may be used when the F100 is in differential mode.



Press the **Hold** (⏸) key to alternate between run and hold modes. **Hold** mode is cancelled when power is turned off.

4.1.2.4 Backlight key (✱)

The backlight is designed to be used for viewing the display in low ambient light levels.

Press the **Backlight** key (✱) to illuminate the display. Once on, the backlight will automatically go off after about 10 seconds (alternatively, press the **Backlight** key again to turn it off).

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Note
Using the backlight will dramatically reduce battery life (by about 30% if used continually at full-brightness).

The brightness level can be set on the **Settings** menu (see later section). Reducing the brightness value will increase battery life when the backlight is used.

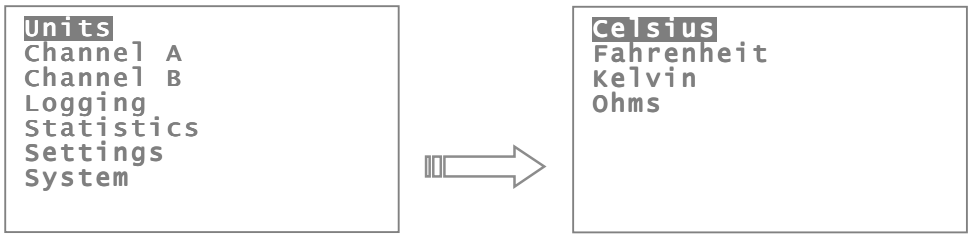
4.1.3 Other menu options

This section describes the other options available through menu selection. Generally, these options are set once and altered rarely. The set-up is stored in non-volatile memory and recalled when power is reapplied.

In the following sections, the top level menu is shown, followed by the sub-menu(s) that it selects.

4.1.3.1 Selecting Units

Press the **Menu** key (▤) to change the measurement units. The **Units** menu will be highlighted. Press the **Enter** key once to reach the **Units** selection menu.



Select the units required with the **Up**/**Down** keys and then press the **Enter** key. Units of Celsius (℃), Fahrenheit (℉), Kelvin (K) or Resistance (Ω) can be selected; the current units are shown on the Measurement Menu screen. Changing units will automatically clear any statistics. The current measurement units are retained when power is removed.

Having selected the new units, press the **Menu** key to return to Measurement Mode.

4.1.3.2 Channel options menu (Channel A or Channel B) – Smart probes

When Smart probes are used, the calibration data is stored in the probe; the coefficients held in the F100 are not required or used.

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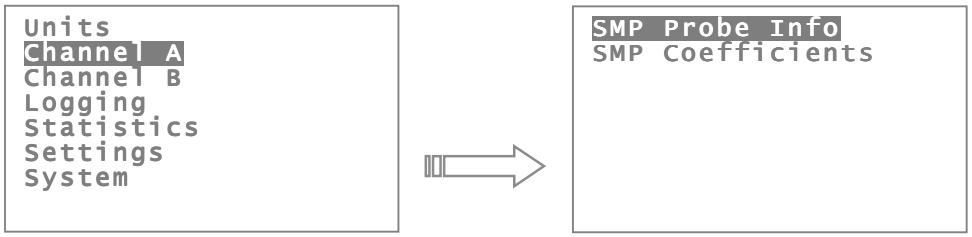
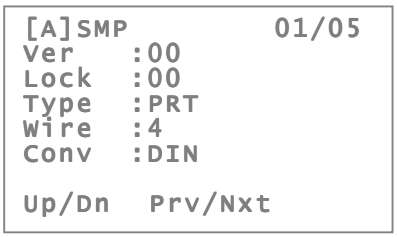
Note

Smart probes use their own internal calibration data. The instrument coefficients are ignored when a Smart probe is attached.

Only channel A operation will be covered (channel A and channel B operate identically). Press the **Enter** key to select the sub-menu. Note that the sub-menu will be different for Smart and Passive probes.

The **Channel** sub-menu is used to review the information about the Smart Probe and to review the coefficients used by the Smart probe.





Press the **Enter** key to select Smart probe information. The display will look similar to the one shown.

The values held by the Smart probe are displayed. Use the **Up**/**Dn** keys to display more of the values held within the probe. Refer to the section on Smart probes for further details; the **SMP Coefficient Menu** is covered in section 4.1.2.

4.1.3.3 Channel options menu (Channel A or Channel B) – Passive probes

Only channel A operation will be covered (channel A and channel B operate identically). Press the **Enter** key to select the sub-menu. Note that the sub-menu will be different for Passive and Smart-probes.

The **Channel** sub-menu is used to change the information about the Passive probe.

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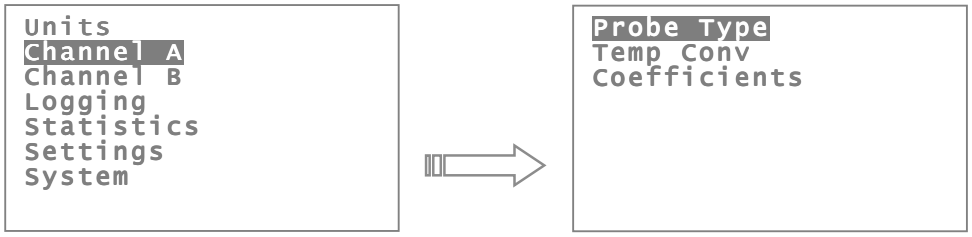
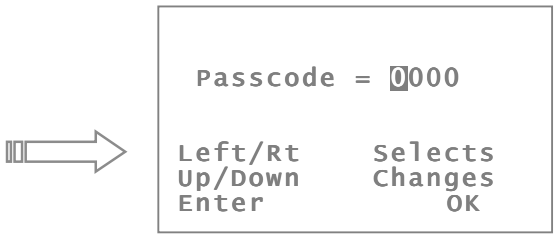


Press the **Enter** key to select **Probe Type**. A **Passcode** screen will appear (see below).

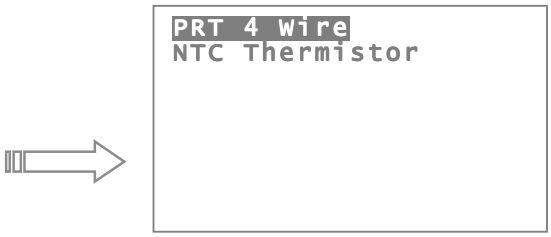
A pass-code must now be entered to proceed any further (since altering the probe-type or other probe information may lead to the display of totally incorrect values). Use the **Up**/**Down** arrow keys to increment or decrement the digit highlighted by the cursor[7]. Use the **Left**/**Right** keys to mover to the next digit and use the **Enter** key once the correct pass-code has been set; this procedure helps to prevent inadvertent changes. Once the code has been entered, it will remain valid until power is turned off[8].



The pass-code for Passive probe entry is **4300**

Once this code has been correctly entered, the following screen will appear.

There are two completely different probe types that can be used with the F100 - i.e. PRT or Thermistor. The probe sub-menu is used to select between these two probe types (this only applies to passive probes). The currently selected sensor type is always shown at the top left of the measurement screen (see the example shown in section 4.1.1).



For example, use the **Down** key to highlight the thermistor probe. If this probe-type is then selected (using the **Enter** key), the thermistor line will be highlighted instead when the menu is entered again.

Selection of PRTs is more involved since the conversion method must also be set at the same time as the probe-type is changed. The **Temp Conv** (Temperature Conversion) menu allows the conversion mode to be set for the currently selected probe.

[7] The values will wrap from 9 to 0 and from 0 to 9

[8] The valid pass-code will have to be entered once any of the three menu-items is selected for the first time.

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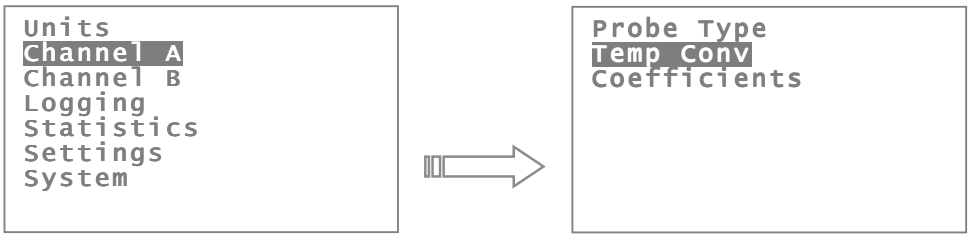

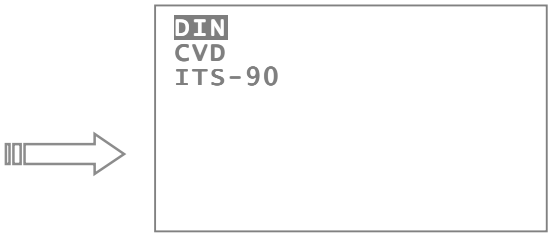

This screen shows that the DIN conversion method is currently selected for this channel. Use the **Up** and **Down** keys to highlight the required conversion method, and then use the **Enter** key to select it.

For PRTs, the instrument provides three standard algorithms for converting resistance to temperature. The choice of algorithm depends on the PRT type and its calibration –

- DIN (1992) - used for un-calibrated industrial PRTs with 0.00385 'alpha' value, to provide a conversion of resistance to temperature in accordance with BS EN60751 (ITS 90) standard
- CVD coefficients - Callendar van Dusen used for calibrated industrial or low alpha PRT's of 0.00385
- ITS-90 coefficients - used for calibrated high alpha PRT's of values 0.003926 to 0.003928

For Thermistors, the instrument provides one standard algorithms for converting resistance to temperature –

- Steinhart and Hart

Both PRT and Thermistor probes must be correctly calibrated to provide their most accurate performance. The F100 can store calibration data for each of the two channels (only required when passive probes are being used).

For Passive-probe PRTs, the coefficients are set from this sub-menu.

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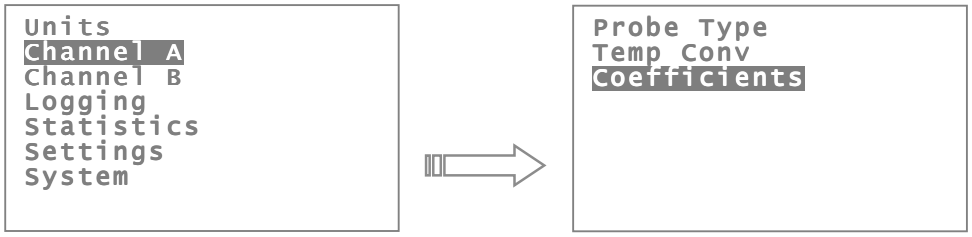
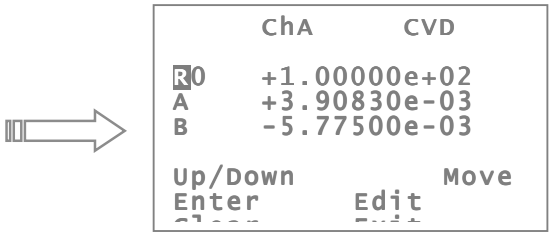


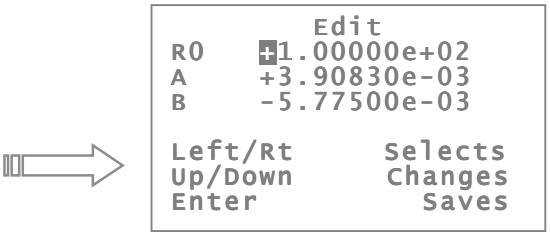
In this example, the edit screen for CVD coefficients is shown; the first character (R) will be highlighted. The screen is still in **Review Mode** (this is the only mode for DIN conversion probes).



Note

The parameters are always fixed for DIN probes and cannot be changed.

In **Review Mode**, the R of the R_0 coefficient will be highlighted. Press the **Enter** key to change to **Edit Mode**. The display will now look similar to the one shown (note that the text on the top line has changed to Edit). The first character of the coefficient will be highlighted (in this case the '+'). This is the current cursor position. Use the **Up** and **Down** keys to change from '+' to '-' and back again (as required). Once the digit value is correct, use the **Left** or **Right** key to select the next digit to be set.



Use the **Enter** key once the complete coefficient has been edited correctly; alternatively use the **Clear** key to abandon editing and move back to the previous menu. The coefficients will be set to the value shown when the **Enter** key is pressed[9].

Once the first coefficient has been edited and accepted, the screen will scroll (if more than three coefficients are required). For example, after entering R_0, the following screen will appear.

[9] Data entry is very similar for thermistor coefficients.

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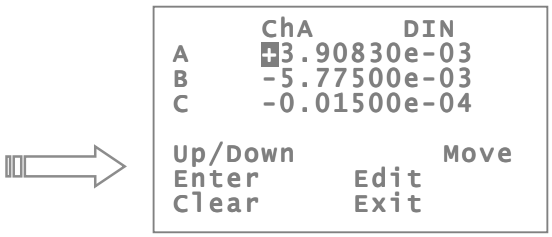
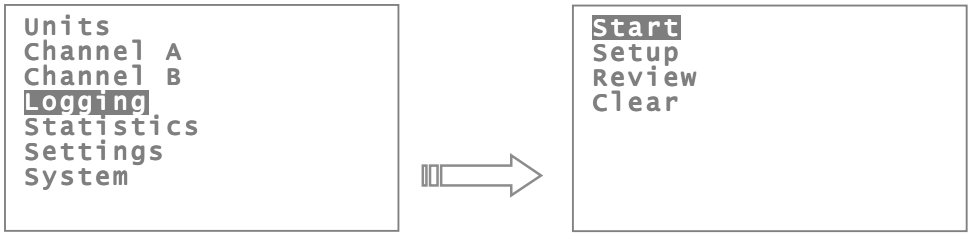


4.1.3.4 Data logging menu

The F100 can log data. Logging status (when the log is on) is always shown on the bottom right-hand corner of the measurement screen (see section 4.1.1).

The instrument is capable of logging a maximum of 8000 data points. The currently selected channel is logged, i.e. channel A, channel B, or the difference (A – B); the currently selected conditions are used. The logging interval may be set so the length of time spent logging can be varied. There are a finite number of data points that can be stored, eventually the log will become full and logging will cease. Logging is cumulative, so that when logging is restarted (after a previous session), the log continues from the previous point to the end (clear the log if you do not need the previous data points).

Press the **Enter** key to select the menu for the various logging options. The exact screen display depends on the current logging-status (this example shows the screen displayed when the F100 is not logging).



Data can be viewed, logged at regular intervals (the interval must be set before **Start** is selected) and logging can be turned on or off.

Logging is started with the **Start** menu. The **Set-up** menu is used to set the current logging interval.

The previously logged values can be looked at when the **Review** menu is selected. The **Clear** menu is used to set the clear the log.

Press the **Enter** key to select the various logging options.

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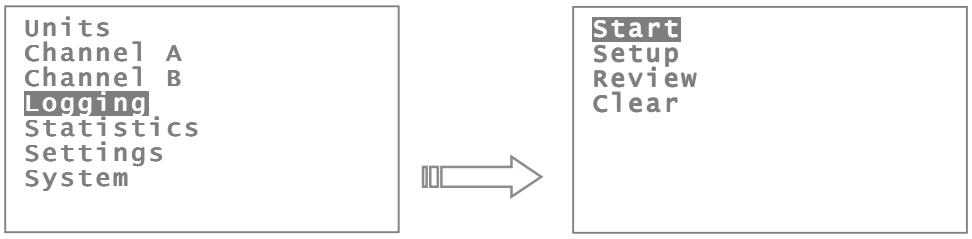


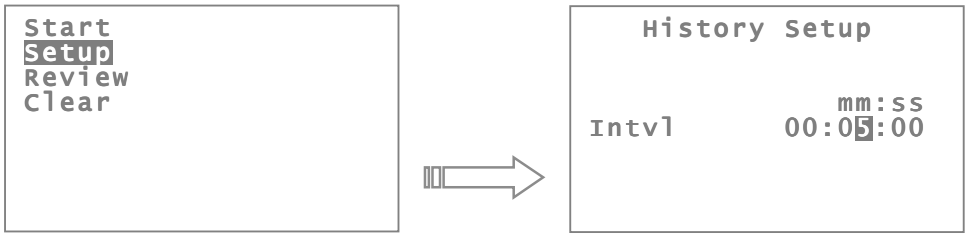
a) Start Log

Selecting this menu option will immediately start logging.

Next time the logging menu is selected (once logging has started), the menu will change to the one shown. Only two options are available now. Logging will continue in the background, so the only options available are to **Stop** logging and to **Review** the log.

b) Setup

Use this menu item to set the logging interval; points will then be logged at this interval. Any time interval between [2 seconds] and [59 minutes 59 seconds] can be used. The example below is set for logging to take place every 5 minutes (the hour values are not active for logging interval setting).



Set a time interval to match your requirements. Logging at slower data intervals effectively increases the total period for which data can be logged. Either select the required interval with the **Enter** key or use the **Clear** key to return to the Measurement Menu.

c) Review

Selecting this option will display the **Review** menu. A message will be displayed if there are no results in the log.

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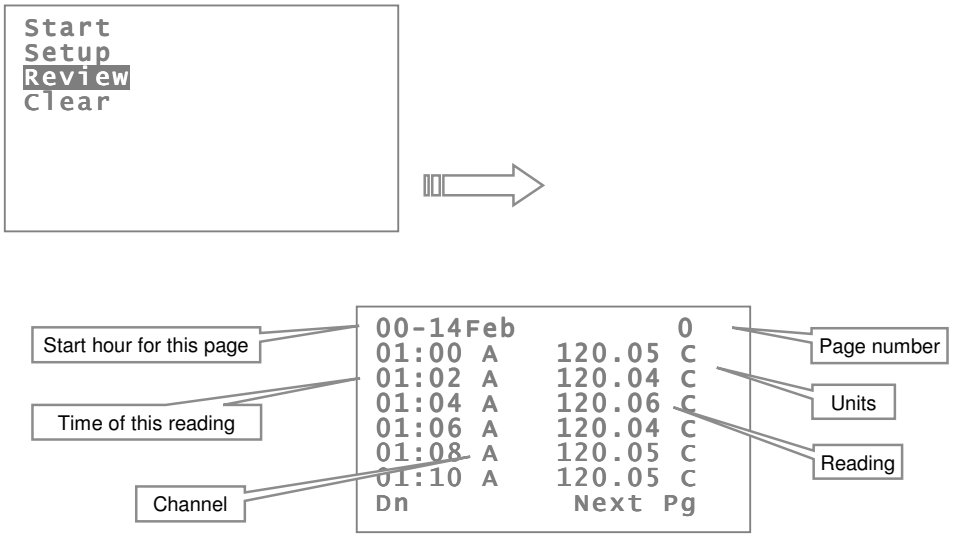


The log shown has 230 results (for channel A in units of °C, logged every 2 seconds). Use the **Down** key to scroll through the logged readings, one page at a time. Press the **Clear** key (❋) to return to the logging menu (pressing the clear key again will return to the Measurement Menu.

Logging ceases at power-off.

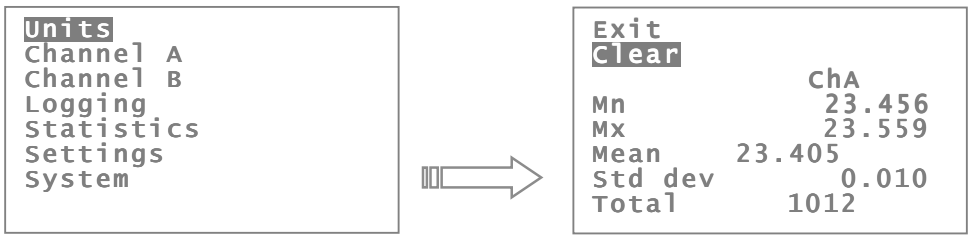
d) Clear

Selecting this option will clear the log immediately and return to the previous menu.

4.1.3.5 Statistics menu

The F100 provides statistics on the data collected.

Statistical information is calculated continuously from the moment statistics are cleared (see sub-menu). Changing any parameter that affects the calculation (e.g. units) will automatically clear and restart calculation. The display is frozen while the values are viewed, although data collection still continues.



The **Exit** option is used to return to the Measurement Menu after viewing statistics. Alternatively, press the **Clear** key (❋) to return to previous menu without clearing statistics.

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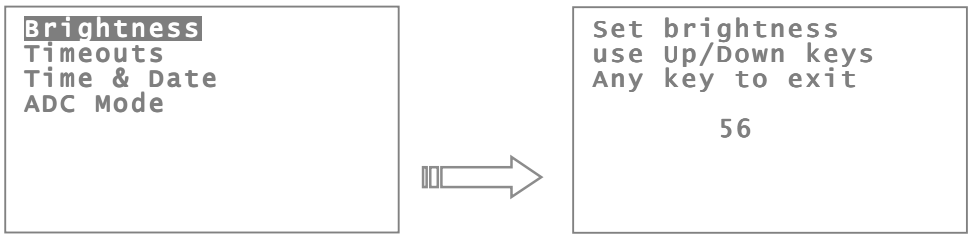
The minimum, maximum, mean, standard deviation and total number of readings are displayed on this screen[10]. Select **Clear** to immediately clear and restart the statistical calculations.

4.1.3.6 Settings menu

The settings menu allows the various other instrument parameters to be set.

a) Brightness

Selecting this option allows the brightness of the LCD backlight to be adjusted. Use the **Enter** key once you are happy with the backlight intensity. Use the **Clear** key to exit without altering the set value. The current value, set by the **Up**/**Down** keys, is shown in the middle of the display (56 in this case); values range from 0 (off) to 100 (full brightness).



Note

Do NOT leave the instrument for any length of time with this menu selection on (it is the only one menu where the backlight is on continuously).

Note

When the F100 is battery operated, using the backlight will dramatically reduce battery life. The current used increases as the backlight intensity rises.

b) Timeouts

The F100 can be set to timeout after a preset period (to save battery life); by default the timeout is off. Selecting this option allows the various timeout values to be set. Use the **Up** and **Down** keys to select the required timeout and then press the **Enter** key to select it (or use the **Clear** key to return to previous menu, or the **Menu** key to return to the Measurement Menu).

[10] Statistical values are also displayed (continuously updated) on the Measurement Menu screen when the clear button is pressed while the F100 is displaying measurements.

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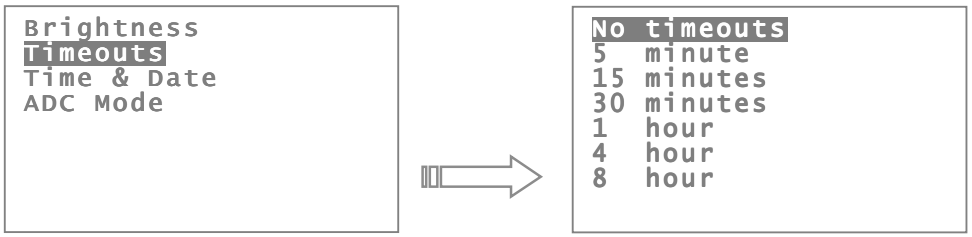
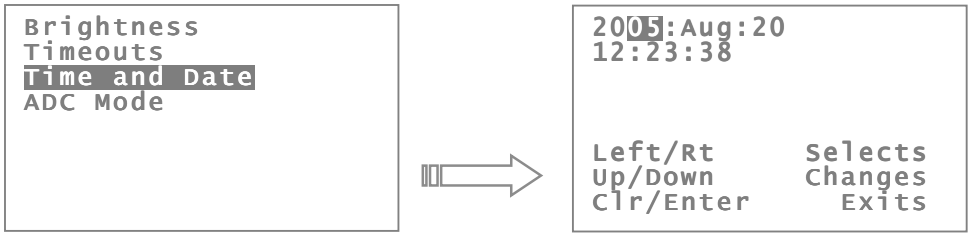


c) Time & Date menu

The F100 contains a real-time clock[11]. The **Time & Date** menu is used to set the current time and date.

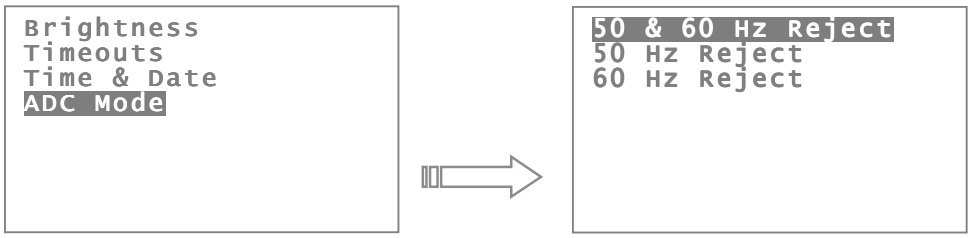
The **Menu** key is used to change the settings. Use the **Up** and **Down** keys to alter the value under the reverse-video cursor. Once the correct value is set, use the **Right** and **Left** keys to move to the next field. Use the **Clear** key to exit without changing the values. The **Enter** key will set the clock to the new values.

It is important to set the clock correctly when using data logging.



d) ADC mode menu

The F100 has been set to 50 Hz & 60 Hz reject (rejection filter) by default. Select 50 Hz or 60 Hz, depending on the operational mains frequency in your area. This can provide better noise rejection. See the menu screen shown below. Select the appropriate frequency.



[11] The clock battery is contained inside the instrument case; the battery pack is not used by the real time clock.

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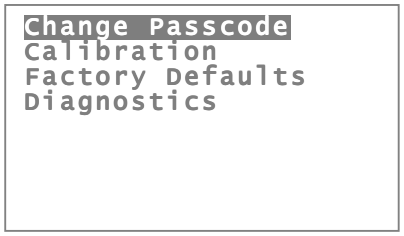
4.1.3.7 System menu

The system menu allows the various other instrument parameters to be set.

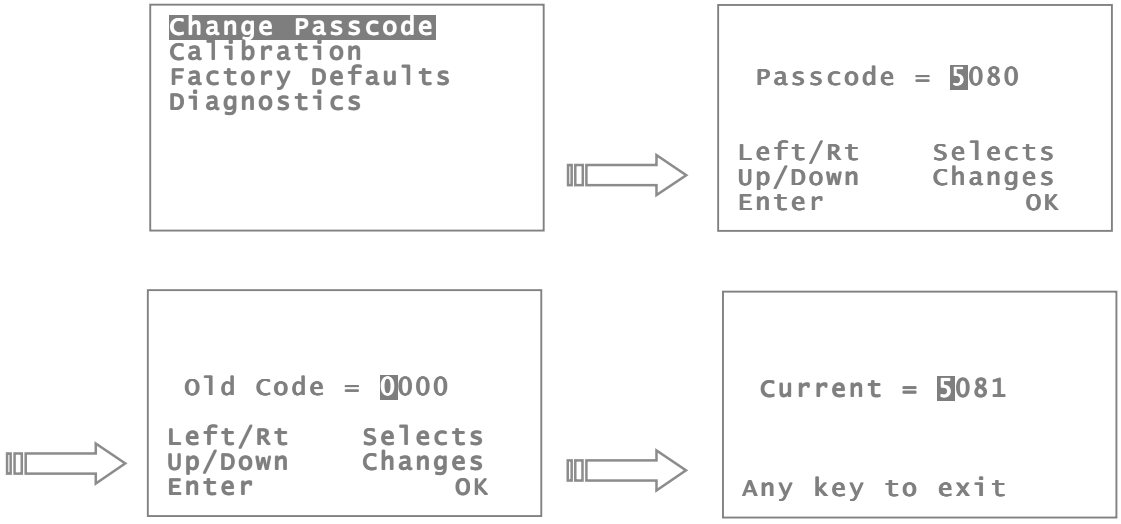


a) Change Passcode

Selecting this option allows the F100 **System** pass-code to be set to another value. The **System** pass-code is required to reset all the default instrument settings – i.e, all values apart from the instrument calibration itself[12]. The current pass-code has to be entered correctly before a new code can be set.

The pass-code for entry to the menu is **5080**

Use the **Up** and **Down** keys to change the pass-code value. Press **Enter** when the current pass-code is correct. The new value can then be set.



[12] Smart probe values will not be changed; however, Passive probe coefficients will be reset.

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b) Calibration

Selecting this option allows the F100 to be calibrated; this procedure will overwrite and replace the exiting calibration data. The correct equipment, environment and accurately calibrated resistors are required.

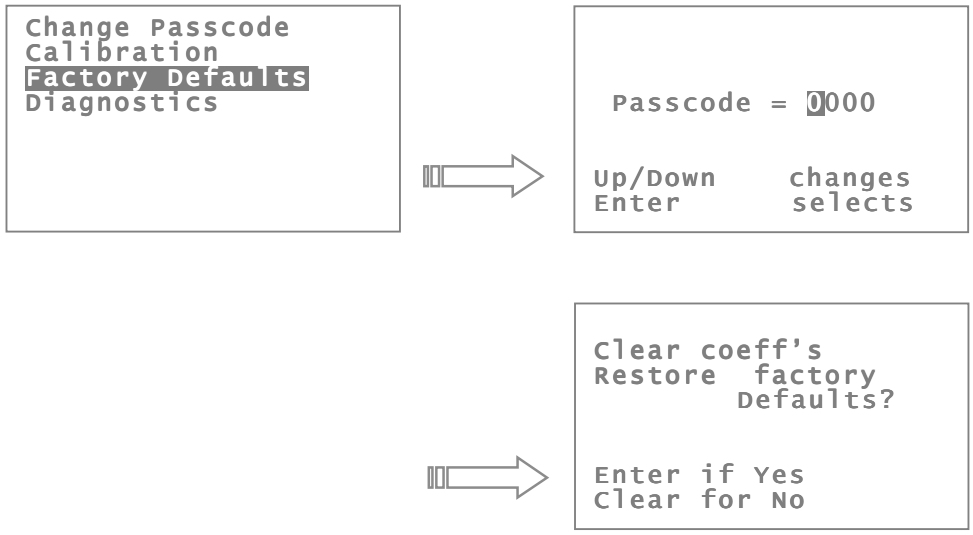
Note

Selecting this option will overwrite the instrument calibration data. Do not attempt to do this unless you have the correct equipment, environment and suitably trained personnel.

The procedure is covered in separate documentation and requires a passcode to for entry.

c) Reset defaults

The instrument parameters can be set to the factory defaults. Selecting this option will overwrite any existing (passive probe) coefficient data and reset the default values for the operational details. To gain access, a pass-codes must be entered first.



Note

Selecting this option will overwrite all probe calibration data and settings. Do not attempt to do this unless you have the correct equipment, environment and suitably trained personnel.

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d) Diagnostics menu

The last menu is not available without entry of the correct pass-code.

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4.1.4 Setting up Temperature measurement

To enable accurate resistance to temperature conversion to be carried out by the instrument, PRT or characterisation data is required for both –

- temperature conversion algorithm, and
- temperature conversion algorithm coefficients

For Thermistors, characterisation data is only required for –

- temperature conversion algorithm coefficients

The data can be stored in either a Smart probe or the instruments' internal non-volatile memory (Passive probe), each thermometer input channel stores one set of PRT/Thermistor characterisation data. See the relevant section above for details on entering the data.

4.1.4.1 Temperature measurement with Smart probe (s)

If a Smart probe is detected on a selected input channel, the PRT calibration data is loaded directly from the Smart probe. Smart probe data always takes precedence over the internal F100 coefficient data (but does not overwrite the instrument data)[13].

4.1.4.2 Instrument calibration

This is not usually a customer option; refer to separate documentation.

4.1.4.3 Firmware Version

The firmware version is shown on the LCD when the instrument is first powered.

4.1.5 Smart Probe review

The Smart probe data can be viewed, but not changed on the F100. The Smart probe data contains the following information.

First LCD screen

Ver	Smart probe data format version
Lock	Password protection state
	0 = Smart probe data locked can not be changed from the instrument
	1 = Smart probe data unlocked can be changed from the instrument

[13] Any calibration data entered is retained for future use a Passive probe.

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Type Probe type PRT or Thermistor

Wire Indicates the probe sensor connection details

Conv Selected method of resistance to temperature conversion algorithm to use, DIN, ITS90, CvD or Steinhart and Hart (for thermistors)

Second LCD Screen

Serial No Serial number of the Smart probe

Source Company that carried out the Smart probe calibration

Third LCD Screen

Cal date Date of the Smart probe calibration

Due date Date the Smart probe calibration is next due

Fourth LCD Screen

Min limits Minimum resistance limit for the probe

Max limits Maximum resistance limit for the probe

Fifth LCD Screen

Min since Minimum recorded resistance the Smart probe has been exposed to since it was last calibrated

Max since Maximum recorded resistance the Smart probe has been exposed to since it was last calibrated

Sixth LCD Screen

Min ever Minimum recorded resistance the Smart probe has been exposed to during its working life

Max ever Maximum recorded resistance the Smart probe has been exposed to during its working life

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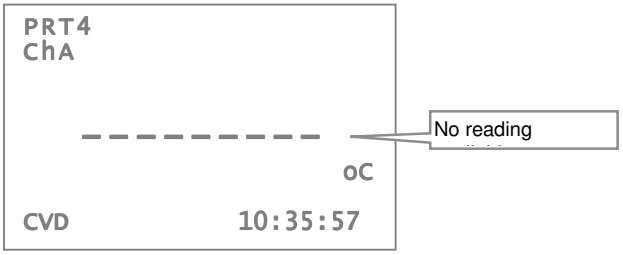
5. Instrument Measurement Range

5.1 Instrument measurement working range

The instrument can detect the following conditions Open Circuit Probe[14], Over Range measurement and Under Range measurement. These conditions are shown by a line of dashes '----------' on the LCD display.



5.2 Measurement Ranges

Measurement Units Thermistor	Conversion	Under Range	Over Range	Units
Resistance	None	0	400,000	ohms
Temperature	S & H[15]	Thermistor dependent		°C/°F/K

Measurement Units PRT	Conversion	Under Range	Over Range	Units
Resistance	None	0	410	ohms
Temperature	Din90	-201	+851	°C/°F/K
	CvD	-201	+850	°C/°F/K
	ITS90	-201	+963	°C/°F/K

[14] Because of the potentially high resistances of thermistors, it may not be possible to determine the difference between connected and disconnected probes for these sensors.

[15] Steinhart & Hart

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6. Smart Probes

6.1 About Smart Probes

Smart probes are similar to passive probes except for one key advantage - all the probe details, calibration data and probe history are stored within the probe itself and not within the measurement instrument.

Smart probes can be moved freely from channel to channel or instrument to instrument without the need to manually enter any data into the instrument.

6.2 How Smart Probes Work

Each Smart probe if fitted with a small non-volatile memory device; this device is transparent during normal temperature measurement.

The probe is interrogated before a measurement cycle and the probe data is read into the instrument for use in the measurement process.

6.3 Smart Probe Data Security

To maintain a high level of data security, the Smart probe has a built in data-lock. If the data-lock is set, the Smart probe data cannot be modified.

6.4 Smart Probe Calibration Supervisor

To assist in maintaining valid calibration, the instrument checks the Smart probe calibration date and compares it with the instruments current date. If the Smart probe date is found to have expired the instrument will warn the user.

6.5 Smart Probe Working Range Monitor

The Smart probe working range monitor is used to monitor a Smart probes working range and to notify a user if it is used outside its specified range.

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7. Calibrating the F100

7.1 F100 Instrument calibration

The dc bridge measurement technique used in the F100 is inherently very stable and linear. However some small drift of the internal reference resistor may occur with time, making periodic instrument re-calibration advisable.

7.2 Equipment

Temperature controlled environment at +20°C ±2°C.

Set of stable, calibrated (1ppm) resistors (3 ranges, 6 resistors).

7.3 Calibration procedure

See separate documentation.

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8. Communications Interface

8.1 Introduction

The F100 is fitted with USB communication interface as standard.

8.2 Overview of the USB Interface

Two modes of operation are available – talk only mode and remote ULOG mode.

8.2.1 Talk only mode

Talk only mode can be set On or Off from the **Options** menu. Talk only mode is useful for outputting data directly to a PC.

8.2.2 ULOG interface

Refer to ULOG documentation and software on the CD.

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9. Options and Accessories

9.1 Accessories

The following options are available for the F100 –

Part Number	Description
F100 Battery Pack	Spare battery pack
FA-SMART	Smart connector
FA-DIN5	5-pin DIN plug
FA-ADAP-250	Adaptor box to allow connection to spade terminal or free wire terminated PRTs
F100-CAL-A	UKAS system calibration at -50, 0, +100 & +250°C
F100-CAL-B	UKAS system calibration at -70, 0, +100 & +450°C
FA-SC100	Soft carry case
EXT-C	Probe extension cable (DIN/DIN)

A range of standard probes are available –

Order Suffix	Description
T100-200-1S	100□ un-calibrated PRT range –50 to +200°C Smart connector
T100-200-1S-NAM	100□PRT UKAS calibration at –50 to +200°C Smart connector
T100-250-1S	100□ un-calibrated PRT range –50 to +250°C Smart connector
T100-250-1S-NAM	100□PRT UKAS calibration at –50 to +250°C Smart connector
T100-450-1S	100□ un-calibrated PRT range –70 to +450°C Smart connector
T100-450-1S-NAM	100□PRT UKAS calibration at –70 to +450°C Smart connector

For non-Smart (i.e. Passive probe) versions of the above, substitute a 'D' suffix in place of the 'S'. For example, T100-450-1S-NAM becomes T100-450-1D-NAM if the Smart connector is not required.

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10. Specification

10.1 Resistance thermometer measurement

PRT characterisation	ITS90 Din90 BS EN60751:1996, IEC60751:1983 CvD BSEN1904:1984, IEC751:1983
Thermistor characterisation	Steinhart and Hart (NTC)
Resistance measurement range (PRT)	1 to 400 ohm
Resistance measurement range (Thermistor)	1 to 400,000 ohm
Temperature measurement range	ITS90 -200 to +962ºC Din90 -200 to +850ºC CvD -150 to +850ºC Thermistor – type dependent
Accuracy	± 0.02ºC (20mK)
Display resolution	0.001ºC
Resistance measurement uncertainty	± 8mΩ (+20 °C ±5 °C)
Temperature coefficient (resistance measurement)	0.2ppm/℃ (0.05mK/℃)
Long term stability (resistance measurement)	± 25ppm (±2.5mΩ) / year (100 Ω reference)
Temperature measurement uncertainty Pt100	Over -200 to +800ºC ± 0.01ºC
Pt100 sense current	1mA (DC) polarity switchable
User selectable measurement display units	ºC/ ºF/ K or ohms
Input channels	PRT or thermistor
Input connection	2 x 5 pin DIN
Measurement configuration	4 wire
Input impedance	> 10MΩ
Max common and differential mode input voltage	±40VDC, 28Vrms

10.2 Display

User interface, display	128 x 64 LCD with (optional) backlight

10.3 Supply

Mains charger supply voltage range	90 – 264Vac
Power consumption	3VA max
Supply frequency range	47 - 63Hz

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10.4 Environmental

Storage temperature range	-20ºC to +50ºC
Service temperature range	0ºC to +40ºC
Specified operating temperature range	+15ºC to +25ºC
Operating relative humidity conditions	<80% RH, non-condensing

10.5 Dimensions and weight

Dimensions	232 x 97 x 53 mm (L x W x D)
Weight	0.5kg (1.1 lbs)

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11. Cleaning and Maintenance

11.1 Cleaning

Make sure the F100 is disconnected from the mains battery charger before cleaning.

Clean the outside of the instrument with a soft, clean cloth, slightly dampened with mild detergent. Do not allow water to enter the instrument.

Warning

Never use alcohol or thinners as these will damage the instrument.

Never use a hard or abrasive cloth or brush.

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12. Service and Warranty

F100 equipment and accessories, (unless stated otherwise), are covered by a 12 month warranty on parts and labour from the date of dispatch from ASL. This warranty does not include costs incurred in returning the equipment to the factory for repair.

12.1 Technical Support

For all technical support, repair, warranty and service inquiries please contact:

Isotech North America
158 Brentwood Drive, Unit 4
Colchester, VT 05446

Phone: (802) 863-8050
Fax: (802) 863-8125

Email: sales@isotechna.com
Web: www.isotechna.com

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